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THE JOURNAL OF PHILOSOPHY

THE THEORY OF ETERNAL RECURRENCE IN MODERN PHILOSOPHY OF SCIENCE, WITH SPECIAL REFERENCE TO C. S. PEIRCE *

THE cyclical theory of time, which is better known under the name of the "theory of eternal recurrence," is usually associated with certain ancient thinkers—in particular, Pythagoreans and Stoics. The most famous among those who have tried to revive this theory in the modern era is unquestionably Friedrich Nietzsche. It is less well known that the theory was defended also by C. S. Peirce and, as late as 1927, by the French historian of science, Abel Rey.[1] The contemporary discussion of the problem of the direction of time has a direct bearing on the problem of eternal recurrence. The primary purpose of this paper is to evaluate critically the theory itself and then to show how this critical analysis can be applied to Peirce's own version of this theory.

The cyclical theory of time claims that each particular state of the universe will, after an enormously long, though finite period of time, occur in exactly the same way in which it has already occurred an infinite number of times in the past. Thus, the whole of cosmic history may be symbolically represented by *one huge closed causal curve*, or rather a *closed causal tube*, whose successive cross-sections represent successive states of the world. In other words, cosmic history may be regarded as an infinite series of identical cycles: what is happening now has happened already an infinite number of times in the past and will happen again an infinite number of times in the future.

The theory is based on three fundamental presuppositions. It assumes

* Read at the meeting of the Peirce Society, University of Vermont, December 27, 1958.

[1] *Collected Works of C. S. Peirce*, edited by Charles Hartshorne and Paul Weiss, I, 498; Abel Rey, *Le retour éternel et la philosophie de la physique* (Paris, 1927).

1. that the universe is made up of distinct atomic entities which persist through time without any intrinsic change, so that they can be identified in different successive moments;
2. that the universe is finite or, more specifically, that the number of its constituent parts is finite;
3. that it is meaningful to speak about a definite "state of the universe" at each particular instant.

The first assumption, about the atomic structure of reality, is not logically indispensable for the theory. Stoics adhered to the doctrine of eternal recurrence without being atomists. On the other hand, there seems to be no evidence that ancient Greek atomists ever had a theory of eternal recurrence. Their explicit belief in an actually infinite number of atoms probably prevented them from considering it; for, as long as the number of constitutive elements of the universe is infinite, it is impossible to speak about any definite instantaneous configuration by which a particular state of the universe at a given instant could be defined. If it is meaningless to speak about any definite state of the universe, it is equally meaningless to speak about the possibility of the *return* of such a state. It is, then, hardly surprising that the theory of eternal recurrence in the modern period appeared only when the belief in the finitude of the universe was joined to the belief in the atomic structure of reality; for only when an aggregate is made up of a finite number of elements, is the number of all possible combinations finite, and only when the number of possible configurations is finite, can one particular configuration recur after a finite period of time. In other words, if the universe can be regarded as an aggregate consisting of a finite number of distinct and persistent elements, eternal recurrence is possible.

There were several reasons why such a belief appeared in the second half of the nineteenth century. At that time the discontinuous structure of matter, though still far from being established beyond any doubt, appeared very probable; the successes of Dalton's atomism in chemistry and of the kinetic theory of matter in physics were too spectacular to be ignored. At the same time, the logical difficulties of the concept of an *actual infinity* were exposed by the critical analysis of Charles Renouvier in France and of Eugen Dühring in Germany. What was even more important was that astronomers, especially Seeliger, pointed out some serious difficulties and even contradictions to which the assumption of the infinite mass of the universe was leading. Thus, the picture of the universe which was emerging in the second half of the last century was that of a huge, though still finite

island of matter in a limitless Euclidean space. If the mass of the universe is finite, the number of its atoms must be finite too; thus we have the first two presuppositions underlying the cyclical theory of time. The correlation of the corpuscular-kinetic model of the universe with the possibility of the identical recurrence of the past was clearly stated by one of the outstanding opponents of the cyclical theory of time, Henri Bergson:

> Now, we say that a composite object changes by the displacement of its parts. But when a part has left its position, there is nothing to prevent its return to it. A group of elements which has gone through a state can therefore always find its way back to that state, if not by itself, at least by means of an external cause able to restore everything to its place. This amounts to saying that any state of the group may be repeated as often as desired, and consequently that the group does not grow old. It has no history.[2]

This is what was intuitively grasped by Nietzsche in the middle eighties of the last century and a few years later proved by Henri Poincaré (1890). Poincaré proved that every mechanical system, no matter how complex it may be, provided it is made up of a finite number of elements, must in a sufficiently long interval of time pass an infinite number of times through a configuration which is infinitely close to that through which it had already passed. The proof of this so-called "theorem of phases" was later simplified by Zermelo and Caratheodory. Thus, no matter how strange and improbable it may appear that we shall be sitting here again in the same room after billions and billions of years, listening to the same paper about eternal recurrence, such an event eventually *must* re-occur as long as the universe is regarded as a finite aggregate of corpuscular entities. As Reichenbach wrote in his posthumous book:

> When we throw a die often enough, a run of a thousand throws showing face 6 must eventually occur, because the probability of such a run, though very low, is larger than zero. When we shuffle a deck of cards just after putting all the red cards on top of the black ones, we shall transform this ordered state into a mixture; but if we shuffle long enough, we must by pure chance eventually come back to the original state, because the probability of arriving at such an arrangement is larger than zero.[3]

A similar consideration can be applied to the whole universe, *assuming, of course, that the universe is like a pack of cards,* that is, a finite aggregate of distinct entities which persist through time and can be identified in various successive moments of their existence. In such a universe, the recurrence of the same con-

[2] *L'Évolution créatrice,* 77th edition (Paris, 1948), p. 8.
[3] *The Direction of Time* (University of California Press, 1956), p. 99.

figuration is not only possible, but, as Poincaré showed, *even necessary* given a sufficiently long time.[4] In such a universe, the distinction between the past and the future is blurred: what has happened in the past will inevitably happen in the future and what waits for us in the future has already happened. The concept of a definite "time-direction" or "time-arrow" loses its significance on the cosmic scale and retains its precise meaning only on a local planetary level as long as it is defined as "passage from a less probable to a more probable state." For the universe as a whole, according to Boltzmann, the distinction between the past and the future becomes as meaningless as that between "up" and "down."[5]

But precisely the assumption that the universe is comparable to a pack of cards has become very questionable in the light of recent discoveries in physics. There is increasing evidence that there are no permanent cards in the game which we call the "universe." Such an assertion may appear surprising because nothing seems to be more solidly established in contemporary physics than the existence of atomic entities such as electrons, neutrons, photons, and mesons. But it is not sufficiently stressed that these ultimate physical elements are profoundly different from the corpuscular entities of classical atomism. Their differences from the rigid particles of Democritus, Gassendi, and Dalton are so radical that it is utterly misleading even to apply the term "particles" to them. The essential property of the classical particles was their immutability; although they were changing their positions and velocities, they always retained the same mass, shape, and volume. Their uninterrupted existence was due to the constancy of their basic geometrical and mechanical properties. Modern microphysical entities lack this essential property of immutability. Their mass varies with velocity according to the laws of relativistic dynamics; their shapes and their volumes are ill-defined in virtue of the principle of indeterminacy. Moreover, they lack even such a fundamental classical property as permanence through time. Their life-span varies widely: while photons from distant galaxies are millions of years old, the age of η-meson does not exceed 10^{-7} sec. We certainly are stretching the meaning of the word "particle" too far when we try to apply it to such evanescent entities. Certainly the term "event" would be much more adequate for describing the microphysical individual, and less tinged by classical associations. For, if we agree with Schrödinger that

[4] *Acta Mathematica*, VIII (1890), p. 67–72.

[5] L. Boltzmann, *Vorlesungen über die Gastheorie* (Leipzig, 1910), II, p. 257.

no particle can be observed twice, we virtually concede that the individuality of microphysical entities is the individuality of *events* rather than that of *things*.

There is no time here for a more detailed documentation. For our present purpose it is sufficient to keep in mind the lack of constancy and the lack of persistence through time of the alleged "particles" of contemporary physics. *But if there are no permanent elements, there are no recurring configurations.* The recurrence of the same configuration presupposes that the same elements occupy the same relative positions in respect to each other as before. But there are no self-identical elements. Thus the first assumption of the modern cyclical theory of time seems to be thoroughly and irrevocably discredited.

It is true that the theory of eternal recurrence does not necessarily presuppose the corpuscular model of the universe. We may define the development of the universe as a succession of instantaneous *states* without specifying these states as configurations of permanent elements. If the universe is described in terms of continuous quantities instead of discrete particles, then a particular moment of the cosmic history is defined by the class of all instantaneous values of these quantities distributed continuously over space. This has been the tendency of all field theories of matter from the early Stoic origins to the modern energetic theories. Then the possibility that at some future instant the total field will be characterized by the same distribution of its values as before does not seem to be contradictory, even though the probability of such recurrence is negligible within the life-span of our solar system or even of the whole galaxy. But granting the validity of the law of the conservation of energy and assuming that the total quantity of energy is finite, then a recurrence of a past state of the universe becomes not only possible, but necessary; for Poincaré's theorem of phase applies to any kind of conservative system.

There is, however, one assumption common to the atomic and the energetic view of nature: *that it is meaningful to speak about a state of the universe at one particular instant.* Whether we define such a state as a configuration of simultaneously existing material elements or as a distribution of simultaneously occurring values of energy, we do assume that the concept of absolute simutaneity remains physically meaningful. But precisely this assumption is now questioned by the relativity theory. As long as we accept the special theory of relativity, we have to deny the existence of events simultaneous in an absolute sense. In Whitehead's words, "Nature at a given instant" does not exist;

or, in Eddington's words, there are no "world-wide instants" which would contain all simultaneous events.[6] Consequently, the concept of instantaneous states of the universe loses its physical significance.

It may be objected that the concept of an instantaneous state loses its objective significance on the cosmic level while remaining approximately valid at our human and planetary level. But this would hardly save the theory of eternal recurrence, which is based on the assumption that it is meaningful to speak about a certain state of the *whole universe* at a given instant. Moreover, even on a microphysical scale we cannot speak about instantaneous cross-sections of any physical process; Heisenberg's principle of indeterminacy excludes instantaneous cuts across an individual world-line as much as the principle of relativity excludes instantaneous cuts across the whole universe. Thus, to speak about "an electron at a given instant" is as meaningless as to speak about "the world at a given instant." In any case, if there is no definite state of the universe at any moment, it is certainly meaningless to speak about the possibility that such a state will occur again. The theory of eternal recurrence stands or falls with the concept of "nature at a given instant." Thus, the conclusion that the cyclical theory of time is incompatible with our present physical knowledge seems to be entirely justified.

But equally serious are some logical difficulties inherent in the theory itself. First, it is questionable whether the concept of absolutely identical repetition is meaningful. In ordinary language the term "repetition" is used in a loose and relative sense; it always suggests that some, possibly very many, *but never all past circumstances* may recur. It was William James who pointed out that when we recognize our present psychological state as identical with a past one, it is precisely *the awareness of the identity* which differentiates the present state from the past one.[7] Without this differentiating element, without this tinge of familiarity, no recognition of identity would be possible. But in the theory of eternal recurrence the repetition of *all* the constitutive features of the *whole* cosmic situation is assumed. For this reason, any consistent theory of eternal recurrence *excludes* the possibility of any recollection of the previous cosmic cycle; for this recollection would constitute a differentiating feature which would destroy the complete identity of repetition. The question now arises:

[6] A. N. Whitehead, *Science and the Modern World* (New York, 1926), p. 172; A. E. Eddington, *The Nature of the Physical World* (Cambridge, 1925), pp. 42–47.

[7] W. James, *The Principles of Psychology*, I, p. 481.

if a recurring cosmic situation is *in all respects identical* with a previous one, how can these two successive situations be differentiated? What is the basis for the claim that the later situation is a repetition of the former? If our answer is that both situations are differentiated "by their different positions in time," we supply the assumption which destroys the whole theory. For the very basis of the eternal-recurrence theory is *the relational theory of time.* According to this theory, it is meaningless to differentiate moments of time from concrete events occupying them. In other words, if two situations are identical in *all* respects, then it is meaningless to speak about their succession, it is meaningless to speak about their two-ness. This is an inevitable consequence of *the principle of indiscernibles* on which the relational theory of time is based. Only then can we claim that time is *cyclical,* that is, that it returns into itself; only then can we claim that cosmic history has returned to the *same* moment. But if we still continue to claim that identical cosmic cycles *succeed* each other or that the present situation is a *repetition* of an infinite number of *previous* situations, we unconsciously slip into the absolutist theory of time. Within the framework of the absolutist theory it is, of course, meaningful to speak about a succession of identical cycles. But then the universal time which contains such cycles *succeeding* each other is not cyclical any longer.

This is the dilemma of the cyclical theory of time: either it remains within the limits of the relational theory of time on which it is based, and then it cannot speak consistently of *recurrence* or *repetition* of successive cycles; or it gives up the relational theory of time by introducing universal, non-cyclical time. But the second alternative means nothing but a suicide of the theory. For this reason the second alternative is never explicitly chosen; but the very language which the cyclical theory of time uses betrays the implicit, semi-conscious presence of the idea of universal, non-cyclical time in the minds of its defenders.

The previous criticism applies to C. S. Peirce's version of the cyclical theory as well. Peirce, as far as I know, never gave a systematic exposition of his theory; what we find in his *Collected Works* (I, 498–500) is so sketchy and fragmentary that it would perhaps be unfair to scrutinize it too closely. He added one peculiar argument in favor of the cyclical theory:

> What is here meant is that time has no instant from which there are more or less than two ways in which time is stretched out, whether they always be in their nature the foregoing and the comnig after or not. If that be so, since every portion of time is bounded by two instants, there must be a connection of time ring-wise. Events may be limited to a portion of this ring, but the

time itself must extend round or else there will be a portion of time, say future time and also past time, not bounded by two instants.

It is difficult to see any force in this argument. It is difficult to see that the continuity of time requires its circular character. Certainly, the irreversible time of Newton is continuous in the sense required by Peirce: *all* sections of Newtonian time are bounded by successive moments. Peirce even complicates his argument by conceding the existence of empty time when he says that some portions of the cosmic ring may be devoid of events. It is difficult to reconcile this with his other claim that physically empty time is not time at all.[8] But even more serious is the incompatibility of Peirce's tychism with his cyclical theory. If events eternally recur, there is no genuine novelty in the world; if what will happen has already happened an infinite number of times, it is difficult to uphold the potentiality of the future. What is the explanation of this particular discrepancy? Professor Goudge called attention to some texts of Peirce which seem to indicate that he was inclined to regard the distinction between the past and the future as merely subjective. He quotes Peirce's statement that "there is no more distinction between the two opposite directions of time than between moving northward and moving southward."[9] This is strongly reminiscent of the similar statement of Ludwig Boltzmann quoted above. But Peirce and Boltzmann were impressed by the reversibility of time in classical dynamics; neither of them was aware of the arguments listed above which contemporary physics opposes to the possibility of the identical repetition of any cosmic situation.

In conclusion, we may say that these hesitancies and discrepancies in Peirce's thought reflect the transitional period in which he lived. By this tychism and by his criticism of classical necessitarianism he boldly anticipated the contingentism of contemporary physics. But this philosophical predecessor of Heisenberg and Whitehead was at the same time a contemporary of Nietzsche. In sharing with the latter the theory of eternal recurrence he merely retained some links with the period of classical science in which he was living and in respect to which he was in other respects so far ahead.

MILIC CAPEK

CARLETON COLLEGE

[8] *Collected Works*, I, 274: "To say there was no motion, no acceleration is to say there was no time. To say there was no action is to say time was no actuality."

[9] Goudge, *The Thought of C. S. Peirce* (University of Toronto Press, 1950), p. 244.

THE PROBLEM OF EPISTEMOLOGY

MY purpose is to propose that a question which I shall state be taken as the central problem of epistemology. The term 'epistemology' may then be defined so that all and only those discussions which are pertinent to this question will be regarded as epistemological. But I should think it hardly worthwhile to provide an additional and peculiar entry for dictionaries. A more important aim is to encourage philosophers to concentrate on the heart of the matter and to avoid extraneous issues which continue to fill the journals with elaborately profitless discussions.

First I shall state, and comment on, the question which is properly the central problem of epistemology. Then I shall criticize some of the problems which have often been regarded as belonging to this branch of philosophy. Finally I shall answer one possible objection to the position outlined here.

But first I wish to make two comments on what follows. The first is that I am aware that there are unsolved problems connected with what is said below. Thus one needs an account better than any now available as to what a clear literal statement in a natural language is. It may, however, give direction to work on the solution of this problem if it is understood that a purpose for which the solution is wanted is to have something as a basis for discussions in epistemology.

The second comment is that, of all the sentences in the following paragraphs, a number are either normative principles or evaluations. I regard these as involving an element of personal opinion, and as views to be held somewhat tentatively. It would, however, be superfluous to begin all of them with such phrases as 'I think that' or 'In my opinion,' but the absence of such phrases should not suggest the absence of a tentative attitude on the writer's part. I see no reason to avoid using such sentences in philosophical writing; on the contrary, an argument could be offered that philosophical writing must contain them, whatever they may lack in the way of finality.

What is to be taken as the fundamental problem of epistemology is concerned with attitudes of belief toward statements; the crucial question—in a preliminary formulation—is 'What statements should an individual believe?' As one makes a quick survey of the history of philosophy and asks what is the point of philosophical discussions of truth, perception, reason, intuition, etc., it seems apparent that the question of belief here formulated has rarely, if ever, been explicitly raised, and yet, a vague awareness that this is the fundamental question seems to have guided, sporadically

and inefficiently, discussions in theory of knowledge from Plato down to the present day. Why should one be interested in distinguishing what is true from what is false except as a means of deciding what ought to be believed?

Though it will be desirable to refine the first formulation of the question, it may be emphasized at the start that the problem to be taken as the central one in epistemology is a normative question; anything that would constitute an answer at all will contain the word 'should' or an alternative normative expression. Also, the problem as stated is one in pragmatics. It is concerned with the attitudes of interpreters of a language toward *some* of the sentences in that language. Furthermore, it is intended that this question have the maximum possible neutrality among philosophical systems. I am here attempting to give an issue greater clarity and precision; it is beyond my purpose to offer a solution, even partial, and it would also be inappropriate to formulate the issue so that some one solution is favored. In particular, the formulation gives an advantage to neither empiricism nor rationalism.

The formulation given makes statements the subject matter of epistemology. The term 'statement' is used here in the sense in which it appears in Quine's *Methods of Logic:* statements are sentences in a natural language; each of them is either true or false; not all sentences in a natural language such as English are statements, and, in particular, neither evaluations nor normative principles are statements.

A common alternative to the present view regards propositions as the subject matter of epistemology. Although the notion of proposition has never, to my knowledge, been explicated with anything like the clarity which characterizes the term 'statement', it appears from most accounts that there is a one-to-one correspondence between propositions and the sentences which, as it is usually put, express them. Furthermore, for most assertions *about* statements there seem to be analogous assertions *about* propositions and vice versa. It might appear, then, that taking propositions as the subject matter of epistemology in accordance with a long tradition would be equally as good as the position taken in this paper. There are, however, advantages in formulating the problem in terms of statements. Foremost among these advantages is the possibility of utilizing, wherever appropriate, contemporary researches in logic and semiotic. Also, speaking of statements rather than of propositions seems to make easier the avoidance of confusions of philosophy with psychology. It is preferable, then, to say that our problem is about statements.

As a first step in refining the formulation of the question account should be taken of the obvious point that there are some sentences which are not within the scope of epistemology at all. Whitman says of grass, "it is the handkerchief of the Lord"; the hymnal says "God is love"; and Croce maintains that "art is vision or intuition." These are, apparently, statements, but there is a good reason why an epistemologist should say neither that such sentences ought to be believed nor that they ought not to be believed. The quotation from Whitman is clearly a metaphor; perhaps 'God is love' is also a metaphor, but this is not clear; and the sentence from Croce, even when examined in its context, is not clear enough to permit profitable discussion of its acceptability for belief. Many sentences in ordinary language are, of course, not to be taken literally. Sometimes a literal interpretation of them may be possible; but this sort of "interpretation" is not without its problems, and the epistemologist should be concerned only with the literal result of the process, whatever it may be, and not with the metaphor itself. And while it may be difficult to establish a useful criterion of clarity, surely it should be required that there be some clear meaning for a statement before the question of believing it is considered at all. Hence it is desirable to say that it is only clear literal statements which are to be the concern of the epistemologist, and the problem may be reformulated at this point as 'What clear literal statements should an individual believe?'

A second consideration will result in a further modification of the question. Although Descartes, and the rationalists generally, have advocated views involving only two attitudes of belief—those of complete certainty and complete disbelief—other philosophers—for example, Locke—have noted that people can and do take toward statements a wide range of attitudes or degrees of belief, including the two which interested Descartes, and also including an attitude of no opinion. There is a problem, subordinate to the central one of epistemology, of providing a useful scale of degrees of belief; in general it should try to provide as many degrees as any epistemologist would want, though anyone may use only so many as he finds convenient.

Historically, of course, epistemologists have been interested in different degrees of belief in order to associate them with different kinds of statements, and some comprehensive classification of statements is needed. There is, however, no place in the literature in which one can find a sufficiently complete classification to permit separation, relation, and adequate discussion of all issues of concern to epistemologists. There are, whether completely satisfactory

or not, classifications among analytic, synthetic, and self-contradictory statements; among universal, existential, and singular statements; and among statements in various levels of language. Further distinctions have been made among statements purporting to refer to phenomena, those purporting to refer to physical objects, those purporting to refer to abstract entities, and those purporting to refer to supernatural beings, and, since statements saying what is remembered and those which are predictions may be affected by different epistemological considerations, some classification involving a temporal basis seems called for. A comprehensive cross-classification of statements that will permit one to take into account all the relevant factors discussed in the history of epistemology is a problem preliminary to the solution of the central problem of epistemology. To avoid confusing the normative issue with the selection of a classification, it will, most likely, be desirable to use no normative or evaluative expressions in setting up the kinds of statements for which normative principles are wanted.

What has just been said about degrees of belief and kinds of statements leads to the following modified formulation of the problem:

> What degrees of belief should an individual accord to clear literal statements of various kinds?

Further refinement of the problem is desirable, but we leave our own peculiar view at this point with the observation that the answer to this question will be a set of sentences all of which will be rules or criteria, none of which will be a statement, all of which will be metalinguistic. A simple example might be:

> If 'p' is equivalent to 'q', an individual should accord to 'p' and 'q' the same degree of belief.

Turning now from the special view which I have been advocating, I shall criticize some of the generally recognized problems of epistemology. I take these problems from the excellent article by Ledger Wood in Runes' *Dictionary of Philosophy*. It will be argued, for each of the eight problems mentioned by Professor Wood, either that it is better regarded as not epistemological at all, or that it cannot be profitably discussed until after we have obtained a solution of the proposed central problem of epistemology, or that, when clarified, it is a part of, or identical with, this problem.

The first problem referred to by Professor Wood is "that of the very *possibility of knowledge*. Is genuine knowledge at all

attainable?'' As formulated, the problem appears to be just as factual in character as the question 'Is salt soluble?' But the formulation only conceals the fundamental question; use of the term ''knowledge' here without a definition makes it appear possible to discuss a factual question, whereas this cannot be done until the normative question stated in the first part of this paper is answered. For what can knowledge be but sound belief? And how can a belief be said to be sound except by reference to a set of rules? Max Black has pointed out that a justification of something requires showing it to be consistent with, or deducible from, a standard. And Carnap has argued that a ''question of right or wrong must always refer to a system of rules.'' Just so, the soundness of belief in a statement is a question of conformity with rules for belief. The term 'knowledge', therefore, has no clear meaning until some answer to the fundamental problem of epistemology has been furnished. The question of whether genuine knowledge is possible is not to be discussed until after a set of rules for belief has been provided. And one may doubt that anything worth talking about in this connection will remain after such a set of rules has been provided.

A second problem is that of determining the limits of knowledge. Again, this appears to be a factual question; again, the question has the misleading appearance of being factual only so long as the term 'knowledge' is not recognized as involving a reference to normative principles; again, the question presupposes an answer to the central problem of epistemology; and again, once the central problem is solved nothing of importance remains to be discussed in connection with the limits of knowledge. For providing a set of rules for belief is also determining what the limits of knowledge are.

The third problem mentioned by Professor Wood is that of ''the *origin of knowledge*. By what faculty or faculties of mind is knowledge attainable?'' One can repeat here the objection to the occurrence of the unanalyzed term 'knowledge'; one can also object to the notion of faculties; but the most important reason for rejecting this question is that discussions of it always or almost always turn out to be inept psychology, or distressing confusions of psychological issues with other questions. My complaint is, of course, an old one; to cite one example, 1937 is the date of the English translation of Carnap's *Logical Syntax of Language*, in which epistemology is criticized as an ''inextricable tangle of problems,'' in which psychological and logical problems are confused. Even when the question being discussed is rather clearly one in psychology—such as Russell's discussion of the origin of

the idea corresponding to expressions of negation—all we have is incompetent psychology. The elimination of confusions of philosophical with psychological issues, and the avoidance of unsound work in psychology under the guise of philosophy are two of the purposes of the foregoing normative, metalinguistic formulation of the central problem of epistemology. The question of the origin of knowledge is best regarded as not epistemological at all.

A fourth problem of epistemology is the methodological problem. Though this is not clear, the question presumably has to do with the procedures which *should* be used in the acquisition and elaboration of knowledge. If this *is* the question, it would seem that the principal purpose to be served by advocating deductive, inductive, or other methods is in connection with the problem of the degrees of belief to be accorded to statements arrived at deductively, inductively, or otherwise. Thus, what we have called the central problem of epistemology is comprehensive enough to include the methodological problem, insofar as this problem goes beyond semiotic.

Professor Wood lists as a fifth question that of the *a priori*. "The problem," he says, "is that of isolating the *a priori* or nonempirical elements in knowledge and accounting for them in terms of human reason." Here again, the term 'knowledge' needs definition, and psychological issues should be avoided. But more important is the need to clarify the term '*a priori*'; is this to be taken as a normative or descriptive expression? Are the assertions that there are or are not synthetic *a priori* statements to be regarded as the matters of fact that they appear to be? Defining '*a priori*' as 'that which can be known by reason alone' (*Webster's International*) or "knowledge independent of experience' (Hofstadter's "Basic Philosophy Data Guide") makes use of expressions which, as we have previously seen, conceal the normative problem, and the normative character of the term '*a priori*' is thereby also concealed. A less misleading formulation of the problem of the synthetic *a priori* is: 'Should any synthetic statements be believed regardless of empirical evidence or its absence?' More generally, if the term '*a priori*' is used as a normative expression, the problem of the *a priori* becomes a part of our central problem. An answer to the fundamental problem of epistemology will be, at the same time, an answer to the problem of the *a priori*.

The sixth of Professor Wood's questions in epistemology need not detain us long. This is the "problem of differentiating *the principal kinds of knowledge.*" From what has been said previously, it seems clear that, when clarified, this problem becomes part of that proposed in the first part of this paper.

The seventh type of inquiry has to do with "*the structure of the knowledge-situation.* . . . [It attempts] to determine . . . the constitutents of the knowledge situation in their relation to one another." The relations among the elements of perception and the relations of the subjective and objective components of the knowledge situation are examples of these inquiries. It is preferable, however, to reject this problem as having no place in epistemology. One readily understands why philosophers have discussed them, but the discussions are either psychological or metaphysical. If psychological, our earlier comments apply; if metaphysical, we should discard them from epistemology, for establishing our criteria for sound statements should precede our assertions of any clear literal statements that there may be in metaphysics.

Professor Wood says, "*The problem of truth* is perhaps the culmination of epistemological inquiry—in any case it is the problem which brings the inquiry to the threshold of metaphysics." It may have brought many philosophers there, but fortunately we may back off without entering. It is, of course, a commonplace that many different questions have become entangled in discussions of truth, and that the first project in unraveling the issues is the problem of defining the predicate 'is true'. Beyond this the intelligible question is: 'What ought to be believed?', or, more precisely, the central problem of epistemology.

Thus, taking the question formulated in the first part of this paper as the central problem to which epistemologists should direct their attention helps to clarify some traditional issues, and assists in separating epistemological inquiries from those in other fields such as psychology and ontology.

Now let us consider an objection to the view we have been urging. We have steadily insisted on the normative character of epistemology, but there are, of course, many who reject any discussion of normative questions. The verifiability theory of meaning, or, as it is more modestly named by its ablest advocates, the empiricist criterion of meaning, condemns as meaningless any answer to our problem. The logical empiricist will graciously allow that rules for belief may be "rich" in their "non-cognitive import by virtue of their emotive appeal or the moral inspiration they offer." The epistemologist in our sense, then, speaks poetry without realizing it or else he is a preacher without a pulpit.

This is not the place to express one's sympathy with the purposes which it was hoped the empiricist criterion of meaning would serve, nor to analyze the proposal at length. It is sufficient here to note that this criterion either does or does not define the term

'meaningful' or the term 'cognitively meaningful'. If the criterion defines one of these expressions, then it is trivial. If it does not, then it is not clear. For surely if there is one thing that is clear, after all the recent discussions of meaning and meaningfulness, it is that these conceptions are not clear, except where some special usage is explicitly indicated. If, then, the criterion is analytic, it is trivial; if it is synthetic, it is obscure.

But, whether the criterion is acceptable or not, it has probably been the center of so much controversy because discussions advocating the criterion have maintained that normative principles are not verifiable and have strongly suggested that they should be discarded as nonsense. We admit, without arguing for these views, that normative principles are different from statements, that only statements can be confirmed, and that no normative principle is either true or false. But from none of these admissions does it follow that discussions in which rules or normative principles are affirmed should be abandoned. Indeed, if they should be, then we cannot say so.

The methods of confirmation and of choice among alternative hypotheses used by scientists or proposed by philosophers of science are, most likely, not to be carried over without modification as a methodology for normative principles. But surely reasons can be given for advocating one set of epistemological rules rather than some alternative. The patterns of inference involved may need further study, but the unsuitability of scientific method should not lead to the conclusion that no method will be suitable.

In conclusion I restate my proposal for the central problem of epistemology: 'What degrees of belief should an individual accord to statements of various kinds?' I have suggested that work in the field will be improved if philosophers concentrate on this question. I also believe that this is one of the great problems which confront all reflective human beings; just as a review of his beliefs led Descartes to doubt and to a need for normative principles governing belief, so a similar review can lead others to a similar need. Perhaps a concentration on their problem will lead to an increased interest in philosophy on the part of educated laymen.

JAMES WILLARD OLIVER

UNIVERSITY OF SOUTHERN CALIFORNIA

COMMUNICATION

The editors recently received the following communication:

To The Editors of the Journal of Philosophy:

When I was in Cairo during the month of Ramadan in 1955, I was inspecting a kind of old book and manuscript booth in the Great Souk. The very elderly white-bearded Arab—his features were not Egyptian—who presided over it looked at me sharply, then brought out his greatest treasure, a fairly extensive fragment of a roll of papyrus. He said, "The gentleman will recognize the value of this papyrus. Before my circumstances were reduced, I was a scholar myself and taught in a madressa. This papyrus, I have been told, dates from before the coming of the Prophet Jesus ibn Joseph. I have the Persian besides the Arabic and the English, and a little Latin. But I have no Greek, and I cannot read it myself, nor can those students of the Law to whom I have showed it. But it must be of great value and interest, for it was found during the excavation near the Tombs of the Califs, south of El Quair, among the tombs of the learned men, in that of Muhammed ben Ali the Wise. I can vouch that it is authentic, for I was there and saw with my own eyes, when his coffin was opened, that it lay upon his breast by his clasped hands, as his jewel of great worth. And this is the very roll that I took when it was laid aside, and hid in my robe."

A brief inspection revealed that the old scholar and thief was probably right, so I paid half the ransom he first demanded, which was modest enough, for his booth was narrow. But it was not till recently that I found time to transcribe and translate my papyrus. It turned out to be indeed of great interest. For it seems to be the Greek text of another version of what appears in our editions as Chapters 4 and 5 of Book III of the *De Anima* of Aristotle. The problems are the same as in the received text, but this text is a distinct variant. It may be that this is the original text, of which our manuscript tradition is a very corrupt version. Or this may be part of a later redaction by Aristotle himself, made at a time when his thought had moved farther from his early Platonism to his more mature Aristotelian position. In any event, it seems so much more in harmony with the rest of the *De Anima* than the chapter 5 of our manuscript tradition that it is worth making it known to a philosophical audience. Hence I suggest that you print the translation in the Journal of Philosophy. The text itself I am sending to one of the classical journals, where the scholars can de-

cide whether this is a fragment of Aristotle himself, or from his later school, or from a commentator.

Faithfully yours,
H. J. L. LADNAR

The translation furnished by Mr. Ladnar follows:

Again, since *nous* is the natural place of universals, and in some sense all universals are in *nous* potentially, just as on a blank tablet all writing can be said to be potentially, as is said in the earlier writings about *nous,* why does *nous* not think always? Why does it not always know everything? What makes *nous* know actually? And when it knows, not as we are said to have knowledge when we are asleep, but as we are said to know when we are awake and exercising that knowledge, why is it that we do not know all universals at once, but only certain universals, now these and now those? This is what must now be inquired into.

Now, nousing (*noēsis*) is in a certain sense like seeing colors by means of the eye. When color is actualized in the process of seeing, we do not see all colors at once, but only those in the range of vision of the eye, which have been actualized by the motion of the diaphanous when it has itself been set in motion by some source of illumination. This actualized medium, the diaphanous in operation, is what is said to be Light. What makes us see is hence Light, and it makes us see the colors on the surfaces within the range of vision of the eye.

In a certain sense, nousing is like seeing; in another sense it is unlike. In what things does it resemble seeing, in what does it not? It is not like seeing in that it is not limited by the range of vision of its organ, as seeing is limited by the range of vision of the eye. If indeed *nous* can be said to have an organ, as the senses have organs, an organ of which it is the power—though not in its being—the organ of *nous* will, it seems, be the phantasmata by which universals have been brought into the nousing power (*to noētikon*), and in which they are embedded. These phantasmata have been generated by sense, and in *nous* there can be actualized only those universals noused in the sensings that have taken place, and been preserved as phantasmata in the phantasia. For, as was said earlier, *nous* is not phantasia, but it is never without phantasia.

But in the phantasia are preserved an indefinite number of phantasmata generated by sense, and an indefinite number of universals corresponding to them. These are in the phantasia in the sense in which we can be said to have knowledge while we are asleep, not in the sense of exercising knowledge when we are awake.

Why do we know actually now this universal in this phantasma, and now that in that? It is not sense that actualizes universals; for though we think of the universal in what we are sensing at the moment, we can also begin to thing of some other universal, which is not in anything being sensed then. For thinking is in our power. Thus though all nousing is of universals in sense phantasmata, sense is not the *archē* of nousing. What makes us know, now this, now that universal? Whence comes the motion of any particular nousing?

What makes us know now this, now that universal, is *logos* in operation as talking (*to legein*) or communicating (*to dialegesthai*). To light in seeing, as the whence of the motion of any particular act of seeing, corresponds *logos* in nousing, as the whence of the motion of any particular act of nousing. This is *logos* not as the power of reasoning (*to dianoētikon*) or of ratiocination (*logismos*), which would correspond to the diaphanous as a medium potentially capable of becoming light. It is *logos* as talking (*to legein*), *logos* in operation. For in all things the mover must itself be in operation. And hence to the *nous* that is moved in knowing, and becomes those universals to which it is moved, and has indeed the power of becoming any universal to which it may be determinately moved, must correspond *nous* such as can move any universal into operation. And the first nous is said to be *nous pathētikos,* passive intellect. But the second *nous* is as *nous poiētikos,* active intellect, and it is that part of the rational psyche which is *logos* in operation as talking or communication.

For *logos* is that part of the psyche that uses words in connected fashion, in sentences that are statements or questions or commands or the like. And it is such a connected use of words that seizes upon the universals in phantasmata and makes us know them actually, in talking and conversing, and in that internal conversation that is thinking, as Plato says. And it is such *logos* that takes us from one universal to another, and another, and from one phantasma to another and another, leaving aside those universals that have no relation to the end and the For What of that *logos. Logos* in operation is thus like the beam of light from a lantern which we carry at night to show us the way: it reveals this step, and then the next, and then the next in turn, until we reach our destination and end, without wasting itself in actualizing the colors of all the surfaces along the wayside and beyond. And it is in this sense that *nous* as *poiētikos* or active, that is, *logos* in operation, can be said to act as "the light of the intelligible world," as Plato somewhat poetically puts it.

But what can we say about what Plato calls "the sun of the intelligible world?" Is there anything in *logos* in operation that corresponds to the sun in seeing what is visible, as the source whence comes the motion of the diaphanous which when so set in operation is light? Now as the sun is to light, as its *archē*, so is truth to *logos* in operation as *to legein*. For truth is clearly the *archē* of *logos* in operation, since . . .

(Here the fragment breaks off. One can only reconstruct phrases like: "sun of the intelligible . . . ," "truth is the whence . . . ," and a few others.)

BOOK REVIEWS

Dreaming. NORMAN MALCOLM. London: Routledge & Kegan Paul; New York: Humanities Press, 1959. vii, 128 pp. (Studies in Philosophical Psychology, edited by R. F. Holland.) $2.50.

This small book is a recent addition to the series of monographs entitled *Studies in Philosophical Psychology* and an expansion of the author's article "Dreaming and Skepticism."[1] In it Professor Malcolm examines with ingenuity the commonly held thesis that dreams are "the activity of the mind during sleep,"[2] and concludes that this thesis is incorrect—not false, but "an unintelligible hypothesis."[3] Further, he discusses some of the consequences, certainly important if true, for science and philosophy of his investigation of dreams. For example, on the basis of his conclusion he is critical of some empirical work on the dating and duration of dreams (Chapter XIII); and he believes he has refuted those philosophers, many in number and often formidable in ability, who have maintained some form of scepticism about judgments of perception on the grounds that there is some difficulty in distinguishing waking and dreaming experience (Chapters XVI–XVIII).

Malcolm's work has the flavor of some of Bishop Berkeley's arguments against material substances, although he makes clear that Wittgenstein is his philosophical mentor. His arguments are succinct and expressed with clarity of style; he eschews the argot and technical apparatus of the contemporary formal language philosopher; he attempts to examine carefully the way language is ordinarily used—how in fact correct usage is learned and sentences

[1] "Dreaming and Skepticism," *Philosophical Review*, Vol. LXV (1956).
[2] *Dreaming*, p. 4; all page and chapter references are to this work.
[3] P. 86.

are verified; and he reaches a conclusion which is as foreign to common sense as it is to philosophic tradition. For Malcolm, one can at least go half way with Hume's comment on Berkeley: his arguments produce no conviction; however, they do admit of refutation.

The similarity to Berkeley holds even when we consider Malcolm's arguments more closely. To show that a sentence such as

(1) X is making a judgment while asleep

is meaningless, Malcolm first argues that it is impossible for anyone to verify (1) directly, that is, to know simultaneously that someone is judging and sleeping. The sleeper X himself cannot observe his state of bodily quiescence characteristic of deep sleep (see Chapter III); and a person who observes him in deep sleep does not observe any signs of mental activity (see, for examples, p. 36 and p. 44). Next he seems to claim that there cannot be any indirect evidence for (1) since direct evidence is impossible (see, for example, p. 43–(3) and the last sentence on p. 44). And then, following the empirical tradition, he concludes that (1) is meaningless, since no evidence is able to testify for or against its truth. What holds for judging and sleeping holds, by the same schema of proof, for any other mental phenomena (see Chapter X); hence, it is meaningless to claim that any mental activity occurs while asleep.

What, then, is a dream if it is not the activity of the mind while asleep? It is the telling of the dream upon wakening—the situation in which the use of the word "dream" was learned. (See Chapter XII, esp. p. 55.) Malcolm admits that "telling a dream is undoubtedly a queer phenomenon," and that we are inclined to claim that "the most likely explanation of our seeming to recall certain experiences is that we did *have* those experiences while we slept." However, we are wrong, for "an 'explanation' explains nothing if it involves an unintelligible hypothesis."[4]

Malcolm's arguments, especially when put into a multiplicity of well-chosen examples and retorts to seemingly reasonable objections, have some force. And so, on first appearance, do Berkeley's arguments against the possibility of evidence for external material objects. But in view of contemporary contributions to the analysis of meaning and evidence, Malcolm's arguments, for all their ingenuity, seem philosophically naive. One cannot criticize Malcolm for not employing some of the now quite familiar distinctions of the formal language philosophers such as Carnap's contrast of

[4] Quoted material from p. 86.

observation terms and theoretical terms, but to shun the recent results of formal analytical philosophy as it approaches maturity is no excuse for committing the errors and extravagances of that philosophy in its wanton youth. It is not clear how Malcolm supports his claim that there can be no indirect evidence for an hypothesis if direct evidence is impossible. Presumably he holds the following principle:

(2) The statement E can serve as indirect evidence for an hypothesis H only if it is possible to verify directly the conjunction of E and H.[5]

It is doubtful that (2) is justified even for hypotheses stated completely in observation terms; but clearly it is much too strong a requirement for the whole language of science and ordinary discourse, for it precludes the possibility of evidence for any sentence containing a theoretical term. The conclusion that Malcolm should have drawn from his subtle and ingenious arguments is not that it is meaningless to claim that mental activity occurs while asleep but that 'dream' should be construed as a theoretical rather than an observation term.[6]

Although Malcolm's main thesis, if established, would be sufficient to resolve all problems concerning doubt whether one is awake or dreaming, he has an independent argument against those who have argued that waking and sleeping experiences might be confused.

> There is, *prima facie*, a simple but devastating objection to the use of the coherence principle for finding out whether one is awake or dreaming. . . . Making use of the principle consists in noting whether certain "phenomena" presented to one are connected in the right ways with other phenomena, past, present and future. The objection that should occur to anyone is that it is possible a person should *dream* that the right connections hold, *dream* that he *connects* his present perceptions with "the whole course of his life." The coherence principle tells us that we are awake if we can make these connections and asleep in a dream if we cannot; but how does the principle tell us whether we are noting and making connections or dreaming that we are? It seems to me that obviously it cannot and therefore the principle is worthless.[7]

[5] See p. 43, for example, where Malcolm claims that electrical phenomena are not indirect evidence for judging while asleep.

[6] Malcolm, at one place, seems to hold this view also. He asserts (p. 65), "I am inclined to believe that statements of the form 'I dreamt so and so' are always inferential in nature," which seems to conflict with his claim (p. 55) that "one must treat the descriptions [of dreams] as the criterion of what the inner occurrences are."

[7] P. 108.

Again, one is able to accept Malcolm's premise and yet reject his conclusion, for he has not stated the coherence principle correctly. Making use of the principle consists in noting whether certain 'phenomena' presented to one *appear to be*, not *are*, connected in the right ways with other phenomena. If they so appear, regardless of whether one is awake or dreaming, then one has evidence, though not conclusive, that he is awake; and if they do not so appear, then one has evidence, again not conclusive, that he is asleep and dreaming. The coherence principle is not a criterion of being awake or being asleep—there is no such criterion—but it does constitute a principle of evidence for these states.

There is another aspect of Malcolm's arguments which has not been brought out by the preceding comments. In various examples he calls our attention to some seemingly paradoxical characteristics of sentences containing pronouns. For example, Malcolm attempts to add support to his rash claim that 'I am asleep' is "without sense and necessarily so,"[8] although 'I was asleep', 'He is asleep', 'I am not asleep' are meaningful, by noting that there is a clearly intelligible use to 'I am here', 'He is not here', 'I was not here', but something genuinely puzzling about the sentence 'I am not here'. It appears that a shift of tense or person, or the insertion or deletion of a negation sign can lead from the meaningful to the meaningless. Although this reviewer is not puzzled by 'I am asleep' as he is by 'I am not here,'[9] he finds the greatest merit of Malcolm's book in the fact that he does call our attention to some of the peculiarities of egocentric words; unfortunately, his unsystematic treatment of this topic does not lead to any positive results.

DONALD KALISH

UNIVERSITY OF CALIFORNIA, LOS ANGELES

Introduction to Symbolic Logic and Its Applications. RUDOLF CARNAP. New York: Dover Publications, Inc., 1958. xiv, 241 pp. $1.85.

The above is a translation by William H. Meyer and John Wilkinson of Carnap's *Einführung in die symbolische Logik, mit besonderer Berücksichtigung ihrer Anwendungen*, Wien, 1954. Correction and changes have been made to the original by the

[8] P. 35.

[9] It is surprising that Malcolm did not 'notice the differences as well as the similarities'; the sentence 'I am not here' contains two egocentric terms (apart from tense-indicators), whereas 'I am asleep' contains only one such term.

author and the translators. Additions, listed for the record on page v, have also been made by the author.

Part One of the text is given to the construction of three languages, respectively labeled A, B, and C. All three are essentially predicate calculi of order omega, or, if you wish, simple theories of types, equipped with sentential constants, individual constants and variables, predicate constants and variables, functor constants and variables, connectives, quantifiers, and the identity sign. Language A carries in addition sentential variables; languages B and C carry Church's lambda operator; and languages A and C carry various signs definable in terms of the above and —in the case of C—the lambda operator.

Chapter A, officially devoted to language A, is a preliminary exploration of the theory of types. Identified among other things are the five major connectives, the universal quantifier and the existential one, the identity sign, the numerical quantifiers, and some predicates from the logic of relations. Chapter B, officially devoted to language B, provides syntactical rules of formation and transformation as well as semantical rules of interpretation for the theory of types. Chapter C, officially devoted to language C, covers sundry items: compound predicate expressions, identity (again), relations, the relative product of two relations, powers of relations, kinds of relations, series, linear order, classes and Boolean functions of such, enumeration classes, the lambda operator, equivalence classes, structures, cardinal numbers, descriptions, heredity, ancestral relations, finitude, infinity, and, to conclude, continuity.

Part Two of the text is given to various applications of symbolic logic. Chapter D deals with thing languages, coördinate languages, and the axiomatic method. The next four present axiom systems for set theory and arithmetic (chapter E), geometry (chapter F), physics (chapter G), and biology (chapter H).

The reviewer has slight misgivings over Part One. The inclusion of three versions of the theory of types seems wasteful and makes for repetitions. Some matters might also be arranged differently. Section 19 of chapter A on isomorphism could profitably be moved to Chapter C, where Carnap treats of relations *ex professo;* section 33a of chapter C on the whys and wherefores of Church's lambda operator should be moved to chapter B, where the operator serves as a primitive sign, or, better still, to chapter A; and the various topics covered in chapter C could perhaps be grouped more systematically. Scant attention is finally paid to the completeness, consistency, and decidability of the theory of

types as a whole and of such sublanguages thereof as the sentential calculus, the predicate calculus of first order, and so on.

Part One has nonetheless its merits, and they are outstanding ones. Carnap offers a full-fledged interpretation of the theory of types and uses that interpretation in chapter A to prove various theorems usually established by purely syntactical means. He also gives a detailed account of some of the class, relation, and function signs definable within the theory of types. He should be heartily congratulated on both scores. Few textbooks bother to interpret the languages they deal with, and the ones that do often bungle the job. Few recent textbooks bother, either, to tap the wealth of signs definable within those languages. Yet a language can qualify as a means of communication only when supplied with an interpretation and when equipped with some defined signs.

As for Part Two, it is in the reviewer's opinion an invaluable piece of writing, which professional logicians as well as students would do well to consult. Current axiomatizations of set theory, the arthimetic of natural numbers, the arithmetic of real numbers, and geometry may be familiar enough. Current axiomatizations of physics and biology, on the other hand, are hardly known. Carnap cannot be thanked enough for including them all in his primer. True, some of the latter axiomatizations are tentative and somewhat restricted in scope. They nonetheless constitute a first step towards the creation of "une langue bien faite" for the natural and the social sciences. It is to be hoped that a study of Part Two will inspire some readers to carry on the awesome task of axiomatizing our sciences.

All in all the reviewer welcomes Carnap's *Introduction* as a major contribution to logic and the teaching of logic.

HUGUES LEBLANC

BRYN MAWR COLLEGE

Introduzione alla logica simbolica. ALBERTO PASQUINELLI. Prefazione di Ludovico Geymonat. Torino: Edizioni Scientifiche Einaudi, 1957. x, 118 pp. L. 1,200.

"Idealism is one of the historical roots of Fascism," said a contributor to *Civiltà Fascista* in 1933. Steady flattery of the regime in these terms had the curious result of making something like the converse proposition true. Fascism became the root from which idealism of the Croce-Gentile variety burgeoned, obscuring rival schools. Philosophies of the empirical or scientific or analytical sort all sank into the shadows, and with them their favored discipline, mathematical logic. An odd turn for history to take

in Peano's homeland—and here "history" does not mean "ancient history." To this day Peano's *Logica Matematica* remains the only full-scale Italian work in its field. This cannot be laid to a sudden failure of talent. Throughout the thirties there were Italians prepared to match the best work of logicians and analysts anywhere. (Geymonat, the author of the preface to this volume, was one of them; the quality of his group can be gauged from his brilliant *Saggi di filosofia neorazionalistica,* Torino, 1953.) These men, however, were—and to a degree remain—deprived of an audience and employement. Even now university curricula are such as to put difficulties in the way of combining philosophic and scientific studies, or of pursuing logic beyond its traditional elements. The younger Italians (like Pasquinelli) who are familiar with logic or philosophy of science are almost to a man the products of training abroad.

This background indicates the importance of Pasquinelli's book and accounts for its plan. It is aimed at a native audience prepared to misunderstand the second word in the phrase "modern logic," accustomed to hear that it names a sterile subject, and unable to deal with literature that might persuade them of its importance to philosophy. The situation calls for something other than the technical manuals familiar to us, although Einaudi does have such a primer scheduled for publication soon. Pasquinelli recognizes that, prior to exercising his compatriots in the novel science of logic, he must convince them that it *is* a science (not a practical art or a character-reading of the Absolute) with its own special objects, function, and criteria of assertibility. He approaches his task much as Carnap would, by arguing that modern logic is to be viewed as a branch of linguistic theory. Its distinctive character is outlined by the actual procedures of contemporary logicians, regarded by Pasquinelli as fabricators of artificial languages, fabricated always with an eye to "interpreting" them so that their syntactical rules will furnish calculi to the scrupulous drawers of inferences in "scientific" and ordinary idioms.

This approach to logic has, of course, touched off a multitude of special inquiries. With terse lucidity, Pasquinelli's small book gives a surprisingly full report on this work. He illustrates logical techniques through a miniature presentation of the propositional calculus; he surveys semiotics and the roles that pragmatics, semantics, and syntactics play within it; he exhibits the involvement of "pure syntax" in the distinctions of analytic from synthetic truth, "formal" from "real" science; he outlines the axiomatic method, and calls attention to its philosophically im-

portant features. While clearly expressing his own views on these and other matters, he scrupulously reports major alternative proposals. Sound, comprehensive, and concise, his book meets a major need of present-day continental students.

WILLIAM J. CALLAGHAN

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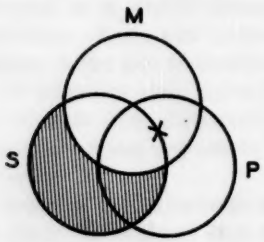

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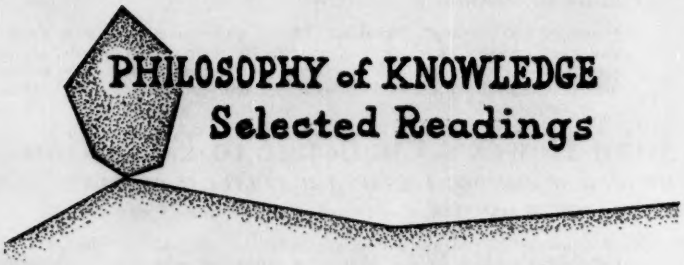

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